Contrasting stomatal sensitivity to temperature and soil drought in mature alpine conifers

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Conifers growing at high elevations need to optimize their stomatal conductance (g(s)) for maximizing photosynthetic yield while minimizing water loss under less favourable thermal conditions. Yet the ability of high-elevation conifers to adjust their g(s) sensitivity to environmental drivers remains largely unexplored. We used 4 years of sap flow measurements to elucidate intraspecific and interspecific variability of g(s) in Larix decidua Mill. and Picea abies (L.) Karst along an elevational gradient and contrasting soil moisture conditions. Site- and species-specific g(s) response to main environmental drivers were examined, including vapour pressure deficit, air temperature, solar irradiance, and soil water potential. Our results indicate that maximum g(s) of L. decidua is >2 times higher, shows a more plastic response to temperature, and down-regulates g(s) stronger during atmospheric drought compared to P. abies. These differences allow L. decidua to exert more efficient water use, adjust to site-specific thermal conditions, and reduce water loss during drought episodes. The stronger plasticity of g(s) sensitivity to temperature and higher conductance of L. decidua compared to P. abies provide new insights into species-specific water use strategies, which affect species' performance and should be considered when predicting terrestrial water dynamics under future climatic change.
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